million tons of basic slag, and a quarter of a million tons of ammonium sulphate. The capacity for the production of high explosive was in March, 1917, more than four times that of March, 1916, and twenty-eight times that of March, 1915.

DR. ROBERT BELL, F.R.S.

DR. ROBERT BELL, who died at Ottawa on June 19, was one of the pioneers in the geographical and geological exploration of Canada. Born at Toronto on June 3, 1841, he studied natural science and medicine at McGill and Edinburgh Universities, and graduated both as M.D. and as D.Sc at the former university. In 1857 he joined the Geological Survey of Canada, of which he became assistant director and eventually acting director shortly before his retirement. In the early part of his career he was also for a short time (1863–68) professor of chemistry and geology in Queen's University, Kingston, Ont.

Dr. Bell's most important work was the exploration and mapping of both sides of Hudson Bay and the Straits, and of the rivers entering Hudson Bay from the south. He also conducted the first surveys of Great Slave Lake, Lake Nipigon, and several other inland waters. As a geologist he paid special attention to the oldest rocks of the Laurentian and Huronian periods, but also made valuable contributions to our knowledge of the Pleistocene glacial deposits of Canada. As a naturalist he was a keen and skilled observer in many directions, but was especially interested in matters concerning forestry. As a medical man his services were at the disposal of several expeditions. Most of his reports were published officially by the Canadian Geological Survey and bear witness to the thoroughness of his researches; while many papers on more general questions were contributed by him to various societies and journals.

Dr. Bell was one of the original fellows of the Royal Society of Canada, and was elected a fellow of the Royal Society of London in 1897. He received the honorary degree of Sc.D. from the University of Cambridge, and in 1906 he was awarded the Patron's medal by the Royal Geographical Society. In 1906 he also received the Cullum gold medal from the American Geographical Society.

NOTES.

THE *Times* correspondent reports the discovery of the skeleton of a mammoth, in association with flint implements, in the neighbourhood of Bapaume, within the lines of the British Army in France. We understand that the British Commander-in-Chief has communicated the fact to the French Government, and that steps have been taken to preserve the specimen until the line of battle is sufficiently far removed to allow of careful excavations being made. The deposit in which the skeleton occurs has already yielded fragmentary remains of the mammoth.

IN reply to a question about the suspension of the publication of the *Kew Bulletin,* asked by Sir W. Byles in the House of Commons on June 26, Mr. Prothero said that the matter was now being reconsidered by the Publications Committee at the request of the Board of Agriculture. He hoped it might prove possible to resume publication.

WE regret to see the announcement of the death at Brussels, in his fifty-third year, of Prof. H. Van Laer, professor of chemistry at Mons, and president of the Chemical Society of Belgium.

NEWS has just reached this country of the death on June 2, at Pusa, Bihar, of Prof. J. H. Barnes, Agricultural Chemist to the Government of India, and late principal of the Government College of Agriculture, Lyallpur, Punjab; and also of Prof. E. G. Hill, principal of Muir College, University of Allahabad.

LIEUT. J. B. JONES, whose death in action on May 31, at twenty-six years of age, is announced, was educated at the University College of Wales, Aberystwyth, and was a B.Sc. in chemistry, physics, mathematics, and geology; he was student-assistant in geology at the above college, and had assisted in the Geological and Soil Survey of West Wales.

ANNOUNCEMENT is made in the *Times* that the Government has been reluctantly forced to the conclusion that it will be impossible to pass a Bill establishing a Ministry of Health during the present session of Parliament. It is possible that the measure may be introduced in the House of Lords, and certain steps taken which will facilitate its progress next session.

THE list of pensions granted during the year ended March 31 last, and payable under the provisions of the Civil List Act, 1910, includes the following:—Mrs. Charlton Bastian, in consideration of the services to science of her late husband, Dr. Charlton Bastian, and of her straitened circumstances, 100*l.*; Mrs. Minchin, in consideration of the scientific work of her late husband, Prof. E. A. Minchin, and of her straitened circumstances, 75*l.*; Mrs. Albert Günther, in consideration of the scientific work of her late husband, Dr. Albert Günther, and of his distinguished services to the British Museum as keeper of zoology, 70*l.*; and Mrs. Roland Trimen, in consideration of the eminent services of her late husband to biological science, and of her straitened circumstances, 75*l.*

BY the death of Sir George Birdwood, on June 28, at the age of eighty-four, the Anglo-Indian services have lost a notable personality. He joined the Indian Medical Service in 1854, and after taking part in the expedition to the Persian Gulf, he was appointed to a professorship in the Grant Medical College at Bombay, which was destined to be the scene of his Indian official life. He cultivated friendly relations with all classes of natives, and contributed to the *Times of India.* Finally, after serving as Sheriff of Bombay, his health broke down, and he left India in 1868, never to return. His administrative ability and fine taste in Indian art secured him a post at the India Office, where he was occupied in organising several exhibitions in which Oriental arts and crafts took a prominent place. For these services he was rewarded with a knighthood and the order of K.C.I.E. His scientific reputation rests on his work on the flora of Bombay, and his researches into the varieties of Boswellia and other sources of Oriental gums and resins. He left few contributions to literature of permanent value, but he was a clever journalist, able to discuss many subjects with wit and vivacity, though his views on history, linguistics, and ethnology were often lacking in the learning of the true scholar. Some of his less ephemeral work was published about two years ago, under the title of "Sva" ("Myself"). His services to the Empire in promoting kindly relations between the European and the natives of India are his best monument.

THE eleventh annual report of the British Science Guild, together with the account of the proceedings at the annual meeting on April 30, has now been published in booklet form. In addition to particulars of the work of the Guild during the past year, the report contains a summary of progress in regard to the promotion of scientific and industrial research, and a series of appendices refers, among other matters, to "The Metric System and the Textile Industries," "Endowment of Education and Research," and "National Instruction in Technical Optics." The report of the eleventh annual meeting of the Guild includes the addresses by Lord Sydenham on national reconstruction, the Rt. Hon. H. A. L. Fisher on science in education and industry, and Mr. H. G. Wells on science in the curricula of our schools and universities. Lord Sydenham makes a number of stimulating suggestions in regard to the reform of education and the development of the material resources of the Empire with the view of solving the many crucial problems that may be expected to arise after the war; Mr. Fisher points out that education in scientific knowledge and method need not be divorced from the study of "humanistic" subjects; while Mr. Wells pleads for the removal of the barriers set up against the latter studies by insistence on the acquirement of such knowledge solely through the medium of the Greek and Latin languages. The booklet is obtainable from the offices of the Guild, 199 Piccadilly, W.1, at the price of 1*s*.

NOTWITHSTANDING the great loss of life caused by the explosion at Ashton-under-Lyne on June 13, the area over which the sound was heard was remarkably small. All the recorded observations lie within a continuous area, extending chiefly in the north-north-west direction to the village of Church, near Accrington, distant twenty-one miles from Ashton. In the opposite direction, the sound-area is not well defined, but the boundary probably passes about six miles from the source of sound. There is no evidence of the observation of multiple reports, the sound at all places more than a few miles from Ashton being a single boom. The shaking of windows immediately after the report points to the existence of long-period air-waves travelling with a velocity slightly less than that of the sound-waves. Though the number of British explosions which have been investigated is small, it is worth noticing that those with double sound-areas occurred during the winter months (namely, Spithead minute-guns on February 1, 1901: Hayle explosion on January 5, 1904; and East London explosion on January 19, 1917), and those with single sound-areas during the summer months (namely, Spithead reviews on July 17, 1887, and June 26, 1897; St. Helens explosion on May 12, 1897, and Ashton-under-Lyne explosion on June 13, 1917). In Japan, according to Prof. Omori, nine out of eleven recent Asama-yama explosions with double sound-areas occurred in the winter, while ten out of eleven explosions with single sound-areas occurred in the summer months.

IN the *Revue Scientifique* for June 9 Prof. Jean Massart advocates the formation of "Une Organisation Scientifique Interalliée," in order to facilitate the exchange of books, students, and men of science amongst the Allied countries, for the publication of *résumés* of scientific work, and for the establishment of scientific institutes. For some years international scientific exchanges have arranged the dispatch of scientific publications from one country to its neighbours post free. It is suggested that this system should be extended so as to permit the free transport of all scientific publications which have no commercial character. Many countries provide travelling scholarships for students who have completed a course of study, but if the annual programmes of work in all universities were equalised it would be possible for a student to take part of his degree course in one country and another part in an Allied country. Prof. Massart also advocates the exchange not only of professors (an example which America has set), but also of librarians, keepers of museums, astronomers, doctors and surgeons of large hospitals, etc Finally, the creation of purely scientific institutes by the co-ordinate action of the Allies is recommended. These research institutes should be independent of teaching, and would be attached to neither schools nor museums. For many sciences the precise situation of the research centre would be immaterial. For such sciences as botany, zoology, meteorology, etc., separate institutes would be required in each of the large climatic and geographical zones of the earth. Thus for biology there might be an Arctic Institute in the north of Russia, equatorial institutes in Ceylon, the Congo, and Brazil, and so on. The strengthening of commercial, industrial, and political relations between the Allies is being urged upon us; as the author says, it is not less important to exchange "ideas and men."

SIR HENRY TRUEMAN WOOD will retire in September next from the post of secretary of the Royal Society of Arts, which he has held since 1879, having previously been editor of the Journal and assistant secretary. He will be succeeded by Mr. G. K. Menzies, who has been assistant secretary of the society since 1908. The council has decided to institute an annual lecture dealing with the application of science to industry in order to commemorate Sir Henry Wood's long association with the society. The Albert medal of the society for the current year has been awarded to Orville Wright, "in recognition of the value of the contributions of Wilbur and Orville Wright to the solution of the problem of mechanical flight." Referring to this award, the report of the council says:—"In 1896 the Wrights began to experiment with gliding machines, continuing the work of Lilienthal and Pilcher, which had been cut short by their deaths. Having obtained considerable success with 'gliders'—for Orville Wright on one occasion succeeded in making a soaring flight of ten minutes—in 1903 they fitted an engine and propeller to their machine, and with this apparatus they were able to make short flights. Inasmuch as this was the first apparatus in which a man was carried in the air by mechanical power, though Langley and others had previously made small mechanical flying machines, it may fairly be considered the first aeroplane in the present acceptation of the word. The machine was patented in 1907. The validity of the patent has never been confirmed by any legal decision, but practically the British Government admitted its validity by a payment to the inventors in 1914 of 15,000*l*. After the initial difficulties had been overcome by the patient labours of the Wrights, the machine developed rapidly. It may be true that in the present aeroplane not much is left of the machine described in the 1907 patent, but the changes, apart from the improvements in the engine on which the modern aeroplane mainly depends for its success, have all been legitimate developments of the ideas of the original inventors, and in no way detract from their credit. It remains, therefore, certain that, whatever value may attach to the contributions of others, the largest share in the honour of having invented the aeroplane must always be given to the two brothers, Wilbur and Orville Wright."

Mr. E. Sidney Hartland, president of the Bristol and Gloucestershire Archæological Society, devoted his annual address, published in vol. xxxix. of the society's Transactions, to a discussion of the legend of St. Kenelm, the boy-saint, whose shrine at the ancient Abbey of Winchcombe, in a beautiful little dale at the foot of the Cotswold Hills, was a famous place of pilgrimage until the Reformation. To-day not one stone upon another of this great religious building remains. The abbey was founded about the end of the first decade of the ninth century by Kenwulf, king of the Mercians and father of the honoured saint, whose remains were probably interred there. But, as is the case with many elaborate legends of this kind, the story of his life fails to stand the detailed historical criticism which Mr. Hartland has devoted to it. The paper, which is very interesting, may be regarded as a study of the value, for historical purposes, of local tradition, and will be valuable both to the antiquary and to the student of folklore.

Much progress has been made during the last century in the scientific treatment of the geography of Ptolemy. But the standard edition by C. Mueller, continued by C. Th. Fischer, is still incomplete, and the condition of the MSS. offers an opportunity for much useful work. In a paper contributed to vol. xxxvii., part i., of the Journal of Hellenic Studies for 1917, Mr. L. O. T. Tudeer examines the maps attached to various MSS., especially that known as the "Codex Constantinopolitanus Chartaceus," which has been assigned to the fourteenth or fifteenth century. At first sight the maps of this MS. give a pleasing impression, but more careful examination discloses various difficulties and discrepancies which it is not easy to explain. Either a copyist has first copied the maps without writing down the names from his authority, and after finishing his work has added names from the text, not from his model, or else the maps did not originally belong to the text, but some draughtsman afterwards traced them, and he has not always been careful to avoid faults and inconsistencies. Mr. Tudeer's careful examination of the MS. material should prove to be of value in clearing up the many difficulties of this great early contribution to scientific geography.

In the *Scientific Monthly* for June, 1917, vol. iv., No. 6, Dr. Jonathan Wright contributes an article entitled "Demonology and Bacteriology in Medicine." He begins with a survey of the beliefs of various savage races, which consider that all, or most, kinds of disease are due to the action of demons or malevolent spirits. This account would be more useful to the student if the writer had not adopted the careless method of quoting his authorities without precise references. He remarks that we may venture to assert that primitive men were right in supposing that "some external agent, demon or bacterium, introduced from without, is the cause of most disease. Indeed, in pointing out the conception of a conflict of the evil spirits of disease with the good spirits that defend the body within, we are perhaps within hailing distance of the time when Hippocrates defined disease as a conflict between opposing forces waged in the bodies of men and animals. It persists as the best definition of disease modern science can give, but the concept did not originate with Metchnikoff, nor even with Hippocrates. For, of the people of the Lower Niger, to whom neither Socratic nor Hippocratic wisdom seems to have penetrated, it is said that 'every medicine to be of any use must have within it a spiritual essence to defeat the operations of the aggressive invader.'"

An admirable survey of the American warblers and their value to the agriculturist appears in the *National Geographic Magazine* (vol. xxxi., No. 4). The author, Mr. Henry Henshaw, described some thirty-six species of these birds, giving details of their nesting habits, distribution, and migration. His essay is supplemented by thirty-two exquisitely coloured figures, drawn by Louis Fuertes, the finest bird artist America has yet produced. His work, indeed, compares favourably with that of the best European artists—and they are very limited in number.

The great snowstorm which crossed Ireland from N.E. to S.W. during January of this year seems to have exterminated a number of resident species of birds throughout the area covered by the storm. A long account of the havoc wrought is given in the *Irish Naturalist* for June by Mr. C. B. Moffat. The thrush was the first to succumb, then the blackbird, stone-chat, golden-crested wren, long-tailed titmouse, grey wagtail, and meadow-pipit. Scarcely any meadow-pipits survived, and the number of summer visitants to the islands seems to be far below the average. This will mean that very few young will be reared this year, since the meadow-pipit is the favourite dupe of the cuckoo, which will in consequence monopolise most of the nests of this bird to the exclusion of the rightful occupants.

Prof. G. H. F. Nuttall, The Museums, Cambridge, is engaged in an investigation on human lice, and desires to obtain specimens and accurate information concerning these parasites from different parts of the world. The specimens should be killed and well preserved in 70 per cent. alcohol; about fifty adults, besides larvæ, if obtainable, are desired from each locality. Head-lice and body-lice should be kept apart. They should be accompanied by brief notes regarding their prevalence on the races or inhabitants of the region whence they are sent. Where specimens are not procurable, any written communication on the subject will be welcomed by Prof. Nuttall, and references to the mention of lice in works of travel may prove useful. Communications may be written in any European language, according to the convenience of the correspondent.

An urgent plea for the establishment of a chair of economic ornithology at one of our universities is made by Mr. W. Berry in the *Scottish Naturalist* for June. By way of illustrating his arguments he gives analyses of the crop contents of a number of sparrows, wood-pigeons, and pheasants. While admitting, as all must, that the house-sparrow sadly needs thinning, he re-directs attention to the fact that these birds do assist in keeping down insect pests. Black game and pheasants are recommended, he remarks, by the Board of Agriculture for wholesale destruction, without distinction of district or topography. Yet an analysis of the crop contents of 183 pheasants made in 1893 disclosed the remains of more than 100,000 injurious beetles and other insects, larvæ, and slugs, while the total number of husks and fragments of corn of any kind was thirty-seven. In another case the crop contents of a single cock pheasant from Argyllshire yielded no fewer than 2286 specimens of Bibio, and 508 of the heather beetle, which plays so prominent a part in the spread of grouse disease, besides tubers of the lesser celandine and fragments of leaves of many species of noxious weeds.

MR. R. J. TILLYARD, of the University of Sydney, has sent us a communication regarding the systematic position of Dunstania, a genus of Triassic insects, founded on a wing described by him in Publication 253 of the Queensland Geological Survey, which has attracted much interest among entomologists in these countries (see, *e.g.*, NATURE of September 28, 1916, p. 75). Mr. Tillyard referred the wing provisionally to a moth, but some of our homeland students have advocated that its affinities are with the Homoptera, or with the Psychodid Diptera, especially with the New Zealand genus Exsul. Close study of further material has now convinced Mr. Tillyard that Dunstania is a dipteron with affinities to Exsul, though he would not place the two genera in the same family, and regards them, not as Psychodids, but as primitive Muscoids. "If, then, I am right in my opinion," he says, "we have to face the remarkable possibility of the existence of muscoid types in Australia in the Trias. This would place the origin of the Diptera much further back in geologic time than has hitherto been deemed at all possible." In concluding his letter, Mr. Tillyard mentions the exceedingly interesting fact that he has "quite recently discovered two well-preserved Panorpid wings in the Permo-Carboniferous Coal Measures of Newcastle, New South Wales." The existence of Holometabolous insects in Palæozoic times may therefore be taken as established.

AN interesting paper on "Herb-growing in the British Empire: its Past, Present, and Future," is published in the Journal of the Royal Society of Arts (No. 3363, vol. lxv.), being a paper read by Mr. J. C. Shenstone on May 2. It is pointed out that the cultivated herbs have always driven the wild products from the market, and it is asserted, no doubt truly, that there is a considerable future for such an industry generally throughout the Empire. Ginger-growing in Jamaica and the clove industry in Zanzibar are both examples of successful enterprises, and it is suggested that gum-yielding acacias and gum Tragacanth, among other things, should be subjected to cultivation.

WE learn from the *Botanical Gazette* for May that the Botanical Station at Cinchona, in the Blue Mountains of Jamaica, has now been leased to the Smithsonian Institution on behalf of fourteen American botanists and botanical institutions that have contributed the rental. It will be remembered that an article on the Cinchona Gardens and Stations was published in NATURE of June 17, 1915, when an agreement was come to between the Jamaican Government and a committee of the British Association for the annual tenancy of the Cinchona Bungalow as a laboratory for botanical research in the tropics. Unfortunately the war has prevented the laboratory being used, as was hoped, by British botanists, but no doubt American botanists will not be slow to recognise the stimulus of such a station for botanical work. The station has already been in American hands, as it was held under lease by the New York Botanical Garden from 1903–13.

A TIMELY article on "Grassland and Ploughed Land," by Mr. R. G. Stapledon, adviser in agricultural botany, University College, Aberystwyth, is published as a supplement (No. 17) to the May issue of the *Journal of the Board of Agriculture.* The national need for a great increase in the home production of corn and potatoes renders inevitable the breaking-up of very large areas of grassland, and throws a correspondingly heavier burden upon such grass as remains, if our stocks of cattle and sheep are not to suffer a serious reduction. In his lucid summary Mr. Stapledon indicates the directions in which grassland can be improved and what is its real significance in a rational system of agriculture designed to secure a maximum production of food. The various types of grassland are characterised, and the appropriate lines of improvement of each type are indicated. Guidance is furnished as to the characteristics of the more desirable grasses and clovers, and suitable mixtures for different conditions are given.

MR. MARTIN H. F. SUTTON has carried out a careful series of experiments with "Humogen" in comparison with other fertilisers, and the results are published as a special bulletin (No. 8) by Messrs Sutton and Sons, Reading. The first series of experiments was carried out on dwarf French beans, potatoes, and red clover, and the supply of "Humogen," or bacterised peat, was obtained from Manchester, where it was being manufactured for Prof. Bottomley. The experiments proved failures, the plants treated with "Humogen" having a stunted and scorched appearance, while those with other fertilisers or farmyard manure grew vigorously. As some toxic or inhibiting factor seemed to be present in the Manchester "Humogen," a fresh and larger series of trials was made later in the year with "Humogen" prepared at Prof. Bottomley's laboratory at Greenford, and with Manchester "Humogen" supposed to be rectified. The results with the latter were as unsatisfactory as in the first series of experiments, but the Greenford "Humogen" gave far better results, and were second only in merit to those dressed with a complete fertiliser. The bulletin is illustrated with an excellent series of photographs.

WE learn from the *Geographical Review* (vol. iii., No. 5) that a strong movement is under way in the United States to develop a survey of the air over North America and adjoining waters. The objects are to observe and chart the irregularities of air currents, to establish aerological stations for observers, not only at the earth's surface, but also aloft to 10,000 ft. or more, and thereby to safeguard aircraft and the lives of aviators. The National Advisory Committee for Aeronautics is fostering the movement, and has the support of the Aero Club of America. The hope is expressed that this survey may in time be put on the same footing as the Hydrographic Survey, the Coast and Geodetic Survey, and the Geological Survey.

A WAR map of Palestine at the low price of 6*d*. has been published by Messrs. W. and A. K. Johnston. The map is in black and white, except for an outline of colour round the chief districts. Relief is shown by hachures, and is fairly successful as regards a general impression, but does not admit of analysis of any small area. There is an abundance of names without overcrowding, but some are difficult to read across the hachures. A list of the chief Arabic terms occurring in geographical names is added. The chief criticism of the map must be as regards the scale, for while the map itself has the extraordinary scale of 1 : 714,649 (11·279 miles to an inch), the inset of Lower Egypt has the scale of 1 : 2,800,000. These are serious blemishes, inasmuch as they prevent ready comparison.

AN interesting presidential address by Prof. W. H. Hobbs to the Michigan Academy of Science in March last on "The Making of Scientific Theories" is printed in *Science* for May 11. The object of this address is to show that "scientific theories, as they are constructed even to-day, with the aid of all modern equipment and inheritance, may contain fatal elements of weakness, though they be promulgated by scientific men of the highest rank and attainments." Men of science are, of course, subject to the limitations of prejudice, undue reverence for authority, and so on, and also they and their critics often fail to distinguish clearly between legitimate theory within those fields where views may be rigidly tested and audacious conjecture. Prof. Hobbs then reviews by means of examples the position of science from the earliest times down to the memorable defeat of Bishop Wilberforce by Huxley in 1860. In the fifth century we read, what sounds like a pessimistic prophecy, that "with the invasions of the barbarian Huns and the Germanic tribes there ensued the eclipse of civilisation. . . ." In this sketch the attempts at the control of scientific theory by the Church were shown gradually to decline, although in this respect the Church was quite powerful even fairly lately. Prof. Hobbs then selects some examples from geology in order "to discuss what may perhaps be called the psychology of theories and the conditions which determine their acceptance": the effect of certain features of Mallet's theory of earthquakes in removing seismology from the field of geology for the period of nearly half a century, and giving it over to the elasticians; the mistaken deductions from the aerothermic and geothermic gradients; Ferrel's mistaken deduction of whirls about the geographic poles, and so on.

AT a time when the supply of our food is controlled by men who probably know little of the science of nutrition and nothing at all of physiological chemistry, the appearance (in the *Revue Scientifique* for June 9) of an article by Prof. E. Gley, entitled "Le Besoin d'Aliments Spéciaux," is particularly opportune. Probably the vast majority of people in this country think that if there is a shortage of any particular article of food it can, in all cases, be replaced by another without detriment to the health of the consumer. As Prof. Gley points out, however, of the four principal forms of nutritive material, mineral salts, carbohydrates, fats, and proteins, mineral salts will not replace, and cannot be replaced by, any of the others. Carbohydrates and fats, which supply energy, are to a certain extent interchangeable, but neither of them is a substitute for proteins which in their turn will not replace either carbohydrates or fats. Further, vegetable proteins will not replace animal proteins. It has been shown by the researches of various workers that neither animals nor man will maintain their nitrogen balance or their body weight when their protein food consists of the zein of maize or of the globulin of lupins. Other proteins, *e.g.* the gliadin of wheat and the hordeine of barley, whilst sufficient to maintain bodily equilibrium, will not promote growth. These two phenomena have been proved to be due, the first to the absence of tryptophane from zein and globulin, the second to the absence of lysin from gliadin and hordeine. In order to maintain the nitrogen balance and to promote growth the protein nutriment of man must contain tryptophane and lysin. It is because meat contains all the necessary amino-acids, and contains them in suitable proportion that it is so valuable as a food. For the efficient working of the digestive system cellulose is an indispensable constituent of food. Rabbits fed on rations containing no cellulose die of intestinal obstruction. The green vegetables ordinarily eaten with meat are valuable as supplying the necessary cellulose. Prof. Gley advocates the consumption of dried fruits for the same reason. These have the advantages over green vegetables that they contain more cellulose and can be obtained independently of the season.

DR. J. S. HALDANE submitted a paper to the recent meeting of the Institution of Mining Engineers upon "The Spontaneous Firing of Coal," in which he summarised the results of the researches carried on during the last four years at the Doncaster Coal Owners' Research Laboratory. Even apart from their purely technical importance, some of the results obtained form a valuable contribution to our knowledge of the physico-chemistry of coal. Thus it has been shown that coal, even in thin slices, is highly impervious to the passage of gas, so that changes of atmospheric pressure can have no appreciable influence on the evolution of gas by solid coal. On the other hand, it is found that coal has an extraordinarily high solvent power for gases, the ordinary atmospheric gases being far more soluble in coal than in water, and, further, the rate of solution of these gases follows Henry's law, just as though they were in solution in a liquid. In the case of oxygen some of the gas is thus dissolved or adsorbed, while some enters into chemical combination with certain of the constituents of the coal. The rationale of the oxidation of coal has been investigated, and the part played by pyrites in such oxidation has been determined, but more research is needed in order to settle the exact nature of the substances most readily attacked by oxygen and of the products of such oxidation.

THE growing interest in special acid-resisting alloys and the many uses found for them has stimulated both the search for efficient materials of this nature and the study of the causes underlying their inertness. The alloys developed by Prof. S. W. Parr for use in calorimeter construction have shown this quality of high resistance to corrosion to a marked degree. The almost perfect insolubility of these alloys in nitric and other acids seems to be conditioned upon a proper mixture of chromium, copper, and nickel, together with smaller quantities of such added metals as tungsten and molybdenum. These additions have so marked an effect in improving both the acid-resisting and casting qualities of the alloys that it has seemed desirable to study their effects more systematically in order that they may be used to the best advantage. This study has been undertaken by McFarland and Harder, and the results of their preliminary investigation have been published in Bulletin No. 93, University of Illinois. The complexity of the mixtures used has made the problem difficult, and has shown the necessity for first obtaining a more complete knowledge of the ternary alloys of chromium, copper, and nickel, and also of the three binary systems underlying them. It is quite obvious from this preliminary study that much more work requires to be done to establish the copper-chromium and nickel-chromium equilibria on a satisfactory basis.

Engineering for June 29 contains an illustrated account of the new Cunard liner *Aurania*, which has just been put on the North Atlantic service. This vessel has extensive second- and third-class passenger accommodation, and has also large cargo holds. The dimensions are 538 ft. 6 in. long, 65 ft. 4 in. beam, and 46 ft. 6 in. depth. The gross tonnage is 13,936, and with geared turbines of approximately 7200 shaft-horse-power she will have a sea speed of fourteen knots when displacing 21,405 tons. The calculated coal consumption is only about four tons per hour, hence the propelling expense will be very favourable in view of the large earning power indicated by the passenger and cargo capacity. The vessel has been constructed under the Convention regulations by Messrs. Swan, Hunter, and Wigham Richardson, and the machinery by the Wallsend Shipway and Engineering Company.

The Board of Agriculture and Fisheries announces the publication of a second edition of vol. iv. of the special reports on the mineral resources of Great Britain, which have been prepared by the director of the Geological Survey in response to numerous inquiries that have arisen through the conditions brought about by the war. In the main it is a reprint of the first edition, wherein the properties, sources, and uses of fluorspar, and details of all workings in Britain, active and inactive, are given.

OUR ASTRONOMICAL COLUMN.

Comet 1916*b* (Wolf).—The following ephemeris for Greenwich midnight is given by Messrs. Crawford and Alter in Lick Observatory Bulletin No. 295. It is based upon revised elements, calculated from observations made by Barnard on 1916 April 24, 1916 December 31, and 1917 April 21:—

1917	R.A.			Decl.			Log Δ	Brightness
	h.	m.	s.	°	′	″		
July 6	22	57	3	24	40	7	0·0496	
8	23	0	15		40	13	0·0461	2·48
10		3	21		38	31	0·0426	
12		6	19		34	58	0·0391	2·53
14		9	11		29	32	0·0357	
16		11	55		22	10	0·0324	2·57
18		14	32		12	50	0·0291	
20		17	1	24	1	30	0·0259	2·61
22		19	23	23	48	8	0·0228	
24		21	37		32	43	0·0198	2·64
26		23	43	23	15	13	0·0168	
28		25	41	22	55	39	0·0140	2·67
30		27	31		33	59	0·0114	
Aug. 1	23	29	14	22	10	13	0·0088	2·68

The unit of brightness is that on April 21, 1917, when the comet was observed by Barnard to be not brighter than 12th magnitude. It is quite improbable that the comet will become visible to the naked eye, as was at one time anticipated.

Comet 1917*a* (Mellish).—Prof. E. Strömgren sends us the following communication from Copenhagen Observatory:—"Prof. S. S. Hough, director of the Cape Observatory, writes:—The discovery of a new naked-eye comet by Warren was announced to us by telephone on April 15. From observations made in this observatory on April 18, 20, and 22 the following elements of the orbit have been derived:—

$$\text{Elements:}\quad \begin{array}{l} T = 1917 \text{ April } 10{\cdot}8043 \\ \left.\begin{array}{l} \omega = 124^\circ\ 32{\cdot}6' \\ \Omega = 85^\circ\ 42{\cdot}9' \\ i = 32^\circ\ 6{\cdot}1' \end{array}\right\}\text{For equinox of date} \\ q = 0{\cdot}1975 \end{array}$$

"The comet is 1917*a* (Mellish)."

Comet 1917*b* (Schaumasse).—The following continued ephemeris for this comet, by Messrs. Fayet and Schaumasse, is based upon elements calculated from observations made at the Nice Observatory:—

1917	R.A.			Decl.		Log Δ	Log *r*	Brightness
	h.	m.	s.	°				
July 4	9	40	50	+10	55	0·2357	0·0691	0·3
8		42	51	9	59	0·2659	0·0885	0·2
12		44	46	9	8	0·2929	0·1073	0·2
16		46	35	8	22	0·3171	0·1255	0·1
20		48	21	7	40	0·3389	0·1431	0·1
24		50	3	7	0	0·3585	0·1601	0·1
28	9	51	45	+6	23	0·3762	0·1765	0·1

The ephemeris is for Greenwich midnight (*Journ. des Observateurs*, No. 18). The comet is now rapidly receding from the earth.

Rotation in Planetary Nebulæ.—In continuation of their previous investigations (Nature, vol. xcvii., p. 268), Prof. W. W. Campbell and Mr. W. H. Moore have announced that the planetary nebula N.G.C. 7662 shows rotational effects very definitely in its spectrum, and that the bright nebular lines are doubled in the parts corresponding to the central region of the nebula. The most satisfactory interpretation is considered to be that the lines are widened by the differential radial velocities in the central part of the nebula, and that an outer stratum of absorbing nebulosity, with a slower rotation, is responsible for an absorption line lying nearly centrally along each bright line (*Popular Astronomy*, vol. xxv., p. 313). The nebula N.G.C. 7026, the general outline of which is a relatively flat ellipse, is also rotating rapidly and the evidence is fairly conclusive that there is an outer equatorial zone of absorbing matter. A further example of high angular speed of rotation has been found in the nebula Jonckheere 320.

THE USE OF ZIRCONIA AS A REFRACTORY MATERIAL.

THE Transactions of the Ceramic Society, vol. xvi., part i., contain an interesting article by Mr. J. A. Audley on the above title. This substance, ZrO_2, occurs somewhat widely distributed, chiefly in the form of the mineral zircon, in which it is combined with silica. A more abundant source has recently been found in the mineral Baddeleyite, which contains from about 80 to 94, and even 98, per cent. of zirconia. This mineral was discovered in 1892 almost simultaneously by Hussak in southern Brazil and by L. Fletcher in Ceylon, the former deposit being much the more extensive and valuable. It also occurs in North America, Australia, and the Ural Mountains. Zirconia is also a by-product of monazite sands. Baddeleyite has a hardness of 6·5 and a specific gravity of 4·4 to 6. It is insoluble in acids, except hydrofluoric acid, but is easily attacked by fused potassium hydrogen sulphate. The melting point of raw zirconia is in the neighbourhood of 2000° C., that of the purified material being considerably higher. It can be both melted and volatilised in the electric furnace. It is a "neutral" substance of the same type as alumina and is said to have a high resistance to the fluxing action of both acid and basic slags. Its heat conductivity is remarkably low, and its coefficient of expansion on heating is nearly as low as that of quartz glass, both of which are very valuable properties. It resists the action of fused cyanides and alkalies.

Dr. J. A. Harker was one of the first in this country to direct attention to the valuable properties of zirconia, but the matter has only recently been taken up for investigation, and much more attention has been paid to it abroad, particularly in Germany, where numerous patents have been taken out. It was applied to the manufacture of muffles, retorts, and tubes by Pyfahl in 1904, and two years later by the Heraeus Company for crucibles in which quartz was to be fused. The suggestion has also been made to replace thoria or yttria as an inner coating for the iridium tube in the Heraeus iridium furnace.

As a lining for electric arc furnaces the natural product is good enough, its high melting point, low thermal conductivity, and small coefficient of expansion making it particularly suitable for this purpose. Now that it is obtainable at comparatively reasonable prices, it can be used for the manufacture of refractory bricks. The market price in Germany before the war varied from 31*l.* per metric ton for the crude mineral to 50*l.* for the 98 per cent. variety. It has been found that a zirconia-lined hearth of an open-hearth steel-making